# Study of Synthetic Jets Formed by a Dual-diaphragm Piezo Actuator


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**ABSTRACT**

Since most of current active flow control technologies require a considerable amount of energy input to drive systems during normal operation, there is a necessity to design and fabricate high-efficiency actuating components to alleviate the associate energy-consuming problem. Due to the advantages of light weight, compact size, rapid time response, and low power consumption, piezoelectric synthetic jet actuators (SJA) have shown great potential to improve aerodynamic performance via manipulating and transporting miniature volumes of fluids in various applications such as flow separation control of aircrafts and attitude maneuver thrust force of micro air vehicles. Some of these improvements will translate into decreased fuel consumption, increased lift, reduction in drag, and hence better vehicle maneuverability. The major objective to investigate the compressible turbulent synthetic jet flow characteristics for developing the indigenous technology capability of designing and analyzing the performance optimization of a dual diaphragm piezoelectric actuator. The maximum displacement and natural frequency of piezo diaphragm will be determined from the finite element analysis. When the fabrication of the actuator cavity and PZT is completed, the SJA will be fully assembled and checked to meet the function requirements. Experimentally, a flow visualization system based on the laser induced particle imaging method and hot-wire anemometer will be established to characterize the time-varying synthetic jet flowfield produced by a dual diaphragm piezo actuator. In the analysis, the computational fluid dynamics approach will be adopted to simulate the transient fluid behavior of synthetic jets. The time sequence of velocity distributions for the jet formation process will be predicted and compared with measured data in order to validate the computer code. During the second stage, this study will further examine the influence of design and operation factors including the orifice width, thickness of the actuator cavity, electrical voltage, frequency, and phase delay of frequency on the performance of synthetic jets in terms of the stroke length and the peak ejected velocity at the orifice for achieving design optimization of SJA.



Keywords : synthetic jet ; synthetic jet actuators ; numerical calculations


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